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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/088,441	06/27/2002	Timothy S Fisher	N8323-EAS	9157

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WADDEY & PATTERSON
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EXAMINER	
TAMAI, KARL I	

ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 01/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/088,441	FISHER ET AL.	
	Examiner	Art Unit	
	Tamai I.E. Karl	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *39-43,45,47,49,51,56,59 and 60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *39-43,45,47,49,51,56,59 and 60* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The objection to the drawings under 37 CFR 1.83(a) is withdrawn.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 45 is rejected under 35 U.S.C. 102(b) as being anticipated Cox (US 5981071). Cox teaches a heat pump with having a voltage source attached to the cathode and anode where the cathode conduction band is curved by a nitrogen diamond coating.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 47 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cox (US 5981071) and Geis et al. (Geis)(US 5713775). Cox teaches every aspect of the invention except the base electrode and cathode interface, and gate electrode. Geis teaches the cathode mounted on a base electrode with the curvature of the band will occur at the interface 34 to the diamond layer, and the use of a gate electrode 32 to extract electrons from the cathode. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the thermionic heat pump of Cox with the electrode/cathode interface or a Gate electrode to provide increase the electron emissivity of the cathode, as taught by Geis.

7. Claims 39, 40, 45, 47, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (US 5984752) and Niigaki et al. (Niigaki)(US 5959400). Tanaka teaches a vacuum thermionic cooling device or a having microtip diamond

emitters 26 having a semiconductor band gap. The geometric tips of the diamonds projecting from the film inherently causing band bending (curvature of the conduction band) from the carbon cathode film. Tanaka teaches the cathode connected to a heat source, with heat being pumped to the anode upon the application of a current to the cathode form a power supply. Tanaka teaches the diamond is hydrogen doped to improve conductivity (band bend). Tanaka teaches every aspect of the invention except Tanaka does not teach the diamond being polycrystalline, the voltage source between the anode and the gate, and a porous gate grid. Niigaki teaches that diamond field emitter cathodes are preferably polycrystalline diamond for electron emission efficiency. Niigaki teaches the voltage between the anode and the gate to provide stable operations where the gate is a porous gate with annular holes (figure 13) to provide a two dimensional array device. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the device of Tanaka with the polycrystalline diamond emitter to provide efficient electron emissions, and with a voltage source between the gate and anode to provide stable operation, and with grid gate to provide larger a two dimensional device.

8. Claims 41-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (US 5984752) and Niigaki et al. (Niigaki)(US 5959400), in further view of Kumar (US 5,399,238). Niigaki teaches a voltage supply between the anode and the gate. Tanaka and Niigaki teach every aspect of the invention except a diamond substrate unitary with the conical or pyramid tips. Kumar teaches a diamond substrate

with unitary a conical and pyramid tip diamond emitters to reduce production causes. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the energy converter of Tanaka and Niigaki with the diamond substrate and tips of Kumar to reduce process steps during production.

9. Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (US 5984752) and Niigaki et al. (Niigaki)(US 5959400), in further view of Kumar et al. (Kumar)(US 5,614,353). Tanaka and Niigaki teach every aspect of the invention except a polycrystalline structure with sp2 bonding. Kumar teaches a polycrystalline structure with sp2 bonding. Since Tanaka and Niigaki and Kumar are used in the field of field emission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the emitter of Tanaka and Niigaki with sp2 bonds because Kumar teaches that sp2 bonds are common atomic bonds for emitters.

10. Claims 56 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (US 5984752) and Niigaki et al. (Niigaki)(US 5959400), in further view of Tavkelidze (US 6495843). Tanaka and Niigaki teach every aspect of the invention except a heat source and the load. Tavkelidze teaches the equivalence of the thermionic converter being a display, heat pump, or having a heat source/load to act as a generator. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the energy converter of Tanaka and Niigaki with the heat source and load to provide electricity to a load.

11. Claim 60 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (US 5984752), Niigaki et al. (Niigaki)(US 5959400), and Tavkelidze (US 6495843), in further view of Kumar et al. (Kumar)(US 5,614,353). Tanaka, Niigaki, and Tavkelidze teach every aspect of the invention except a polycrystalline structure with sp2 bonding. Kumar teaches a polycrystalline structure with sp2 bonding. Since Tanaka, Niigaki, and Tavkelidze, and Kumar are used in the field of field emission, it would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the emitter of Tanaka and Niigaki with sp2 bonds because Kumar teaches that sp2 bonds are common atomic bonds for emitters.

Response to Arguments

12. Applicant's arguments filed 9/26/2005 have been fully considered but they are not persuasive. Applicant's argument that Geis is not analogous art because it is not at thermionic heat pump or generator is not persuasive. Geis is analogous art because they are both thermionic emitters, as shown by Cox (col. 1, line 40). The Applicant's argument that Tanaka does not teach an enhancement means is not persuasive because Tanaka teaches both the diamond tip emitters which inherently causes a curvature of the conduction band and a gate electrode which cooperates with the diamond tip emitter to emitter electrons to the anode. The Applicant's argument that Tanaka does not teach a power supply applying an electrical bias of sufficient potential to cause band bending is not persuasive. Tanaka teaches a gate electrode 18 which

causes the emission of the electrons to flow between the cathode and the anode. Applicant's arguments regards figures 1-3 are not persuasive because the band bending of the figures is caused by the enhanced tips such as the diamond emitters of Tanaka (see applicant's specification page 6).

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karl I.E. Tamai whose telephone number is (571) 272 - 2036.

The examiner can be normally contacted on Monday through Friday from 8:00 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Darren Schuberg, can be reached at (571) 272 - 2044. The facsimile number for the Group is (703) 872 - 9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Karl I Tamai
PRIMARY PATENT EXAMINER
December 28, 2005

KARL TAMAI
PRIMARY EXAMINER